FOLDABLE AND PORTABLE CUPBOARD

MOHD RAHMAT BIN AHMAD SUHAIMIN

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Faculty of Mechanical Engineering
UNIVERSITI MALAYSIA PAHANG

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ABSTRACT

Cupboard functions as storage to store clothes and make clothes arrangement systematic and tidy besides protecting our clothes .Cupboard by itself have faced evolution from first time it had build until now. We can see there are so many differences between the older cupboard and the new one. Differences in context of design, material they used, and the way to assemble it. However, there are obviously two types of cupboard which are permanent assemble and foldable. The foldable cupboard nowadays is designed using fabric as the structure cover and aluminium and PVC as the frame of cupboard. Yet, it is not stable, not durable and has short life spend. Due to this problem, a new portable and foldable cupboard is developed. There are four concepts, it was suggested those concept 4 is decided to be the best concept. The installation process of the cupboard is discussed into detail between pilot designed and actual product. Later, this cupboard is modeled using SolidWorks software. Further, the scale of 1:4 is used to fabricate the pilot model. After the fabrication process, it is founded that the designed modeling of foldable is specified to fold the cupboard is totally different compared to pilot model due to lack of resources. Still, folding design for both modeling and pilot modeling can be used as actual folding method because the material selection which is PVC for structure cover are high in strength and have moisture resistant compared to current product. The processes to fabricate this cupboard used cutting, joining, and finishing.

ABSTRAK

Almari berfungsi sebagai storan menyimpan pakaian, membuat susunan pakaian sistematik dan kemas disamping melindungi pakaian. Almari dengan sendirinya telah menghadapi evolusi dari kali pertama ia telah direka bentuk hingga sekarang. Kita boleh lihat dimana terdapat banyak perbezaan antara almari lama dan yang terbaru. Perbezaan dalam konteks reka bentuk, bahan yang digunakan dan cara pemasangannya. Bagaimanapun, terdapat dua jenis almari yang mana jenis pemasangan tetap dan mudah lipat. Almari mudah lipat sekarang ini direka bentuk menggunakan fabrik sebagai penutup struktur dan aluminium dan PVC sebagai bingkai almari. Hal ini menjadikan ianya tidak stabil, tidak tahan lama dan mempunyai jangka hayat yang singkat. Oleh sebab itu, satu almari mudah alih telah direka bentuk. Terdapat empat konsep, konsep 4 diputuskan untuk menjadi konsep terbaik. Proses pemasangan almari dibincangkan secara terperinci antara produk sebenar dan model. Kemudian, almari ini dilakar semula menggunakan perisian SolidWorks. Selanjutnya, skala 1:4 telah digunakan untuk mereka bentuk model almari. Setelah selesai proses pemasangan, terdapat perbezaan almari sebenar dengan model disebabkan kekurangan sumber. Bagaimanapun, kaedah lipatan untuk kedua-dua model ini masih digunakan sebagai kaedah lipatan sebenar. Pemilihan bahan yang mana PVC untuk menutup struktur adalah tinggi dari segi kekuatannya dan tahan lembapan berbanding dengan produk semasa. Kaedah-kaedah pemotongan, pengerudian, pemasangan, dan kemasan digabungkan untuk mereka bentuk dan membina sebuah almari yang lengkap dan sempurna.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

For this chapter, it is discuss about the problem statement, objective of the project, scope of the project, and lastly project background.

1.2 PROJECT BACKGROUND

This project is about to design and fabricate a foldable and portable cupboard. This type of cupboard is innovated from the already product sold in the market. This cupboard is able to fold into the smaller part when disassemble and need assembling process to assemble it back. This cupboard also is a portable. Portable here means it will be easier for user to move it to another place as it can be folded when disassemble and store it in small storage (case) when the user need travelling.

1.3 PROBLEM STATEMENT

At the market, most of cupboard produced is for static position and not portable. Some research based on certain cupboard that already sold in market and found some problems with it:

- Not portable
- Some product only focusing on hung the cloth and fold the cloth
- Easy to expose to dirt and dust
- Non durable(can’t support in large number of cloth) and also the material used is not durable
- Difficult to make some cleaning work on the cupboard

Many of cupboard nowadays is not portable and only designed for static position in households. It even heavy and difficult to assemble and disassemble. To overcome this problem, a portable cupboard that will be folded, light easy to install and uninstall was designed. This type of cupboard is suitable for the person that always travel from one place to another place and he or she can bring this thing along them if they want a cupboard that will fulfilled all their needs.

1.4 OBJECTIVE

The objective of this project is:

i. To design a foldable and portable cupboard.
ii. To fabricate the cupboard that used plastic as main material

1.5 SCOPE

The project scope consists of two scopes which are:

i. This study is focused on fabricate a foldable and portable cupboard.
ii. Cupboard is able to fold into smaller part

1.6 FLOW CHART

A flow chart, or flow diagram, is a graphical representation of a process or system that details the sequencing of steps required to create output.

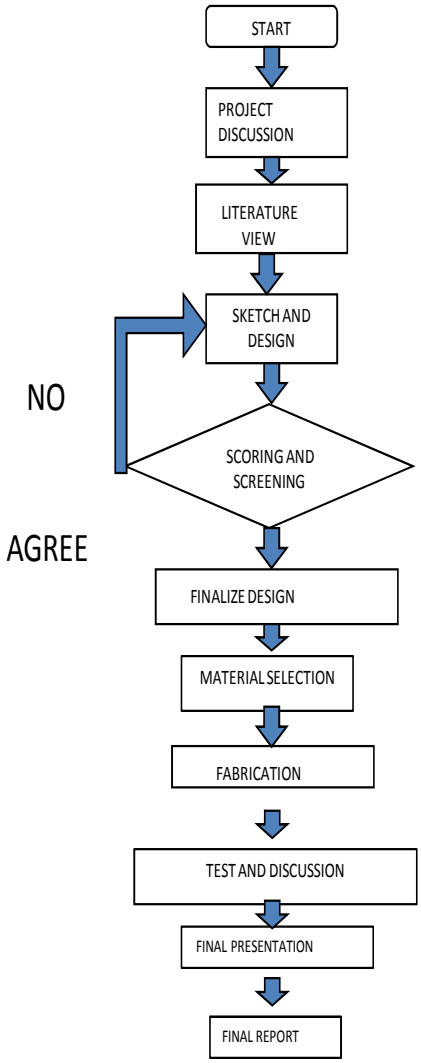

Figure 1.1: Flow Chart

1.7 GANTT CHART

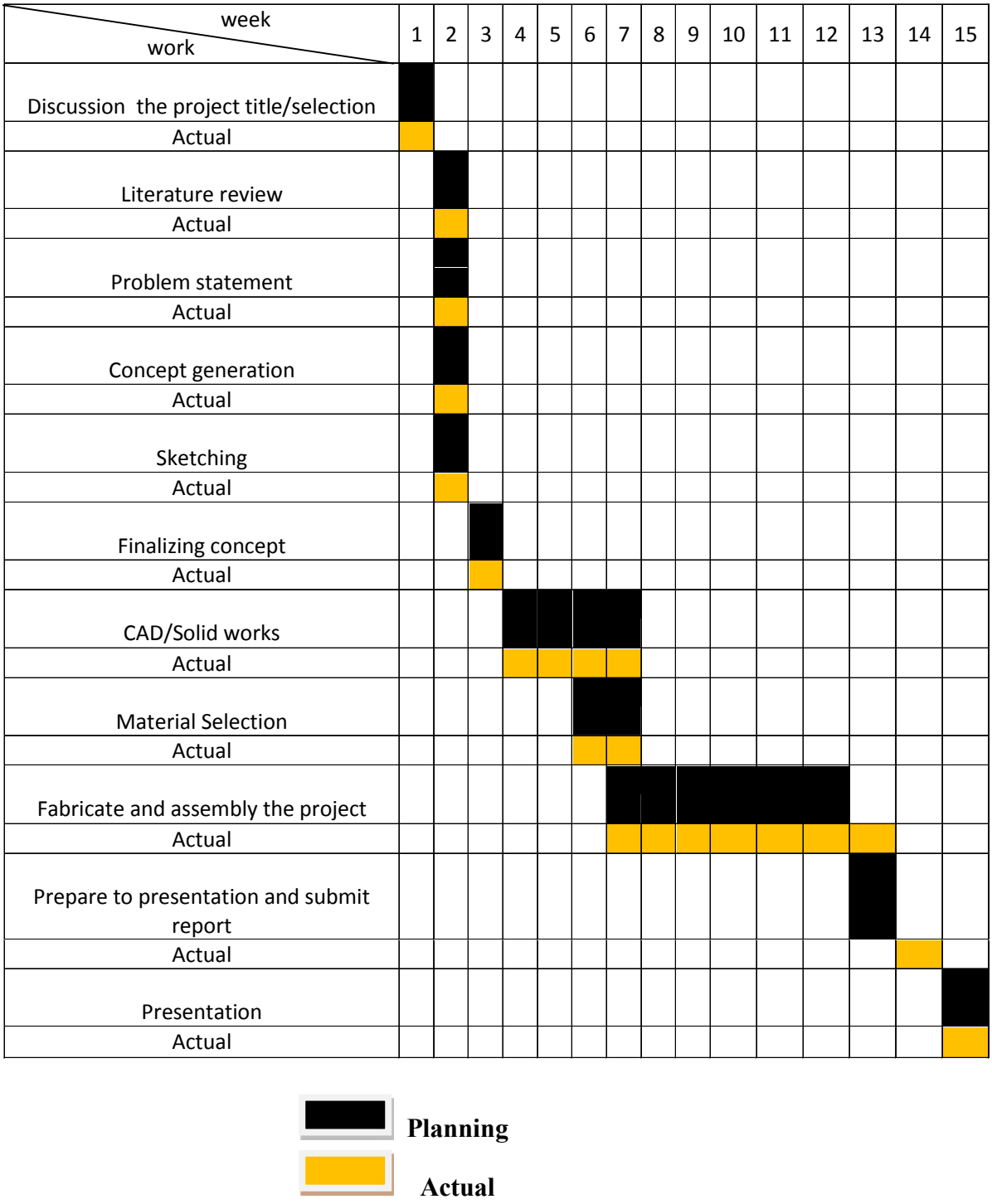

Figure 1.2: **Gantt Chart**

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter is the literature review of the project. In this chapter, there are several types of cupboard and its design. Besides that, it consists of designs which are available at the market.

2.2 TYPES OF PORTABLE CUPBOARD

2.2.1 CANVAS COVERED CUPBOARD

Figure 2.1: Design 1

Cupboard in figure 2.1 is a type of portable and foldable cupboard that made up from canvas for outer part, plastic round hollow bar as structure, and wood as the folded cloth basement. It only has a compartment which is compartment for folded cloth.

Advantages:

I. Easy to assemble and disassemble

-Plastic is used to made up the structure of this cupboard and use plastic “L” to join all the part. Process to assemble this cupboard is easy as it only use plastic “L” as joiner and user can assemble entire of cupboard in short of time.

II. Light weight

-Entire body of this cupboard is made up from light weight material. All part like canvas, plywood, plastic hollow round bar, and “L” joiner were light weight material.

III. Cloth free from dust and dirt

-This cupboard is a closed type cupboard, so, it is difficult for dust and dirt to through in.

IV. Good stability

-This cupboard has good stability design. It has low center of gravity as it has low height and has wider width.

Disadvantages:

I. Don’t have hung cloth compartment

-This cupboard design only focused on folded cloth and there are no place for hung cloth

II. Not Durable

-The outer part of this cupboard is made up from canvas. In period of time, it will broken due to ware and it will broke easily when touched with sharp material.

2.2.2 FABRIC COVERED CUPBOARD

Figure 2.2: Design 2

Figure 2.2 shows cupboard that usually found at the market. This type of cupboard used fabric to cover all cupboard structure. It used the plastic as the joiner to joint steel rod with another rod. These cupboards consist of hang cloth compartment, and shoes compartment.

Advantages:

I. Can store large quantities of cloth
   -This cupboard has large space. So, it is adequate to store large quantities of cloth.

II. Strong structure
   -As it structure is made from hollow steel rod, so, this structure has well in strength to store the big number of cloth.

III. Keep the ironed cloth straight
   -As it has the hung cloth compartment, it can keep ironed cloth in straight.

IV. Light weight

-This cupboard is made up from light weight material. Material such as steel hollow rod, fabric, and plastic joiner can be categorized as light weight material.

Disadvantages:

I. Fabric covered is not durable

-This cupboard covered by thin layer of fabric, in short of time, it can break due to ware.

II. Don’t have folded cloth basement

-At the bottom of this cupboard is a rack for shoe and at upper part is compartment for hang cloth. There is no compartment for folded cloth.

III. Fabric door bend after unzipped

-The position of fabric door bend after unzipped makes the user difficult to zip it back and this also make it looks terrible.

2.2.3 FABRIC COVERED CUPBOARD 2

Figure 2.3: Design 3

The outer part of this cupboard is made from fabric, structure is made from hollow steel rod, and plastic for joining rod by rod. This cupboard is different from design 2 in figure 2.2 as it has stage or rack for folded cloth.

Advantages:

I. Can store large quantities of cloth
   -This cupboard has large space. So, it is adequate to store large quantities of cloth

II. Strong structure
   -As it structure is made from hollow steel rod, so, this structure has well in strength to store the big number of cloth.

III. Keep the ironed cloth straight
   -As it has the hung cloth compartment, it can keep ironed cloth in straight.

IV. Light weight

-This cupboard is made up from light weight material. Material such as steel hollow rod, fabric, and plastic joiner can be categorized as light weight material.

V. Tidy arrangement of cloth

-Every single compartment of this cupboard is arranged orderly. So, it makes the arrangement of cloth look tidy and systematic

Disadvantages:

I. Fabric covered is not durable

-This cupboard covered by thin layer of fabric, in short of time, it can break due to ware.

II. Unbalance folded clothes arrangement

-As the folded cloth basement is made up from fabric, clothes arrangement will not balance when number of clothes increase.

2.3 FABRICATION PLANNING PROCESS.

2.3.1 Measuring

Before all desired material and part go to the cutting process, parts or material must be measured first in order to get accurate measurement according to drawing. Measuring tape is used in this process.

Figure 2.4: Measuring Tape

2.3.2 Cutting

After all the material required measured, the next process to be done is cutting the material. All materials and parts will be cut based on the required desired shape and dimension. The following process will be used to cut those materials are cutting by using bandsaw and hacksaw.

Figure 2.5: Vertical Bandsaw

2.3.3 Joining Process

Joining process is s process where every part of the project is mated. In this project, screw and glue will be used to join every single of part.

Figure 2.6: Screw

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

A methodology is instantiated and materialized by a set of methods, techniques and tools. A tool is any instrument or apparatus that is necessary to the performance of some task. A methodology does not describe specific methods; nevertheless it does specify several processes that need to be followed. It also allows others to replicate our study and run new and different studies that are based on our methodology.

3.2 SELECTED MATERIAL

3.2.1 PVC Plate (Main part)

Figure 3.1: PVC plate

This PVC sheet is used for main part to cover all cupboard structure and as the folded cloth basement. PVC is an abbreviation for Polyvinyl Chloride. This PVC has thickness of 3mm. PVC sheet's specification are:

1) Resistant to chemicals and corrosion
2) Smooth or matte surface
4) Abrasive-resistant
5) Easy for machining and welding
6) Flame retarded
7) Impact-resistant
8) Weather resistant
9) Excellent UV resistance
10) Good insulation
11) Aging-resistant
12) Moisture resistance

3.2.2 PVC hollow bar (Electrical Casing)

This hollow bar is used to be the frame of cupboard substitute the actual part in actual drawing. The reason why this material is selected is because of it has light weight, and it can be divided to two part that used snapping process to join it. Measurement is 530mm (length) x 20 mm (wide) x 10mm (wide)

Figure 3.2: Electrical Casing

3.2.3 Screw

Screw will be used as a fastener to join PVC plate. This type of screw is made up from steel. It has 10mm length.

Figure 3.3: Screw

3.2.4 Plastic Angle Brackets

This plastic angle brackets is made from PVC. It is white in color and has measurement 25mm x 20mm in 45 degree angle. It is used in mate the PVC electrical casing 90 degree horizontally.

Figure 3.4: Plastic angle bracket

3.2.5 Clear Plastic Hinges

This clear hinge is made from plastic. The measurement of this hinge is 23mm (height) x 30 mm (width). It is used for mating PVC sheet plate so that the PVC plate can be folded. It is also used in making mechanical movement on the cupboard door as the door is opened and closed.

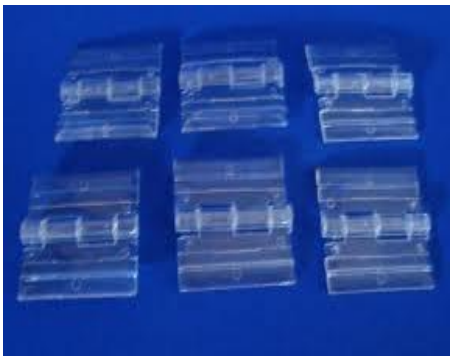

Figure 3.5: Clear Plastic Hinge

3.3 DESIGN GENERATION

3.3.1 Concept A

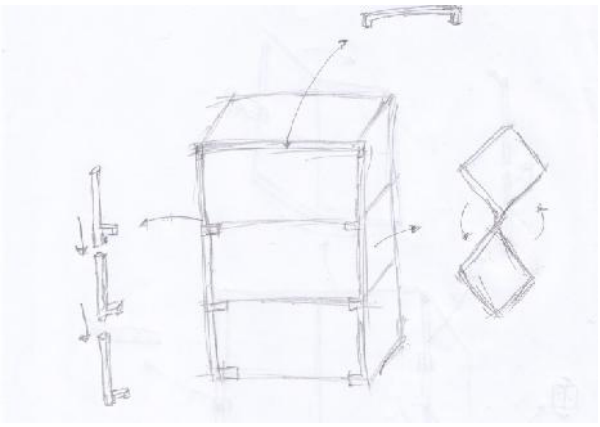

Figure 3.6: Concept A

a) Advantages:

This design is simple and light weight. Only consist of folded clothes compartment. All covered part is made up from plastic so this will prevent the dust or the other contaminants contact to the clothes.

b) Disadvantages:

Don't have doors, it used sloth and this so messy. Don't have place to hang the clothes. The structure is also not strong enough to support large numbers of clothes.

3.3.2 Concept B

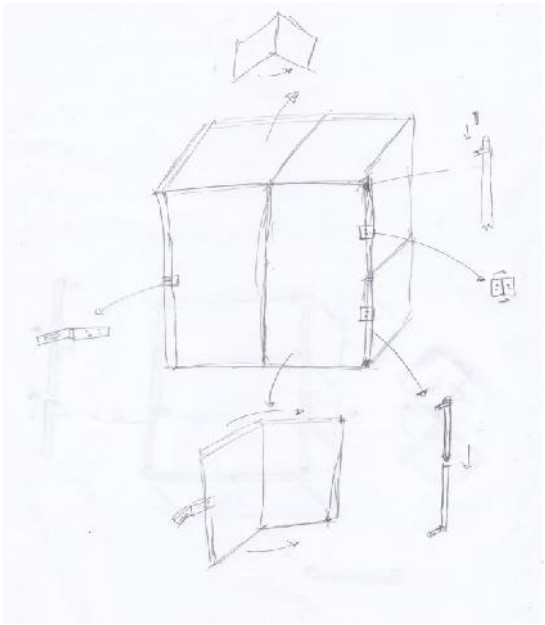

Figure 3.7: Concept B

a) Advantages:

This concept of cupboard has door and it will be easier to take and place the cloth. Can store large quantities of clothes.

b) Disadvantages:

Structure is not strong enough to support large number of clothes. Only one side of door can be opened.

3.3.3 Concept C

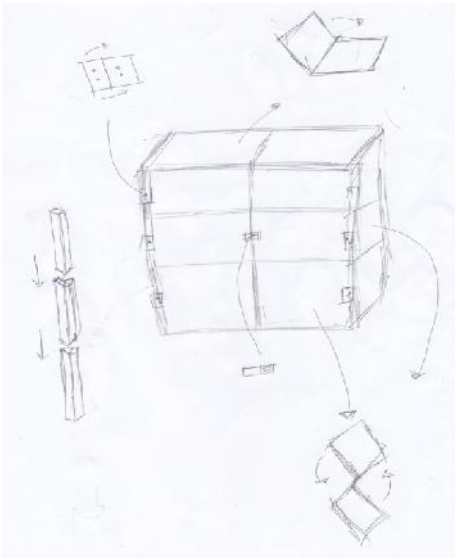

Figure 3.8: Concept C

a) Advantages

It has light weight and has both hang cloth compartment for ironed cloth and folded cloth basement. This cupboard has two doors and both door is able to open and closed.

b) Disadvantages

Folded cloth basement is not strong enough to support large quantities of clothes.

3.3.4 Concept D

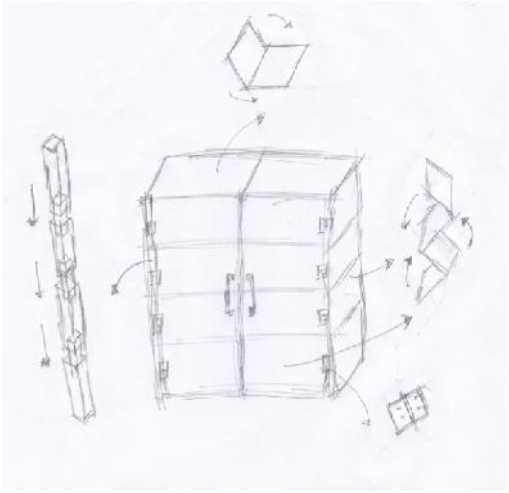

Figure 3.9: Concept D

a) Advantages:

This cupboard is able to store large quantities of cloth. It has hang cloth compartment and folded cloth compartment. Majority all part in this cupboard are able to fold and the size after fold are small. The cupboard door is able to open and closed. This structure is strong to support large numbers of clothes.

b) Disadvantages

Need skill to assemble and disassemble.

3.4 SELECT FINAL CONCEPT

After the design concept, the best design is studied to relate it with criteria selection. Then make decision which design is the best. For this project, design concept 4 is the best after considering the criteria selection. Table 3.1 is used to select which criteria is the best.

Table 3.1: Screening method

Characteristic	**Concept**				
	A	B	C	D	5(Datum)
Portability	+	+	0	+	0
Stability	0	0	0	+	0
Ease of manufacture	-	-	0	0	0
Smaller size after folded	0	-	+	+	0
Manufacturing cost	-	-	0	0	0
Quantity of cloth	0	+	+	+	0
Ease of assemble	0	+	+	+	0
Sum of (+)	1	3	4	5	-
Sum of (0)	4	1	4	2	7
Sum of (-)	2	3	-	-	-
Net Score	-1	0	4	5	0
Rank	5	4	2	1	3

+ = Better Than - = Worse Than 0=same as

Design concept D has the higher net score than the other concept. So this concept has been chosen to be the final concept and will be fabricate.

3.5 FINALIZE DESIGN

Design concept 4 has selected as final design after had selecting final concept design. Below show the design in isometric view.

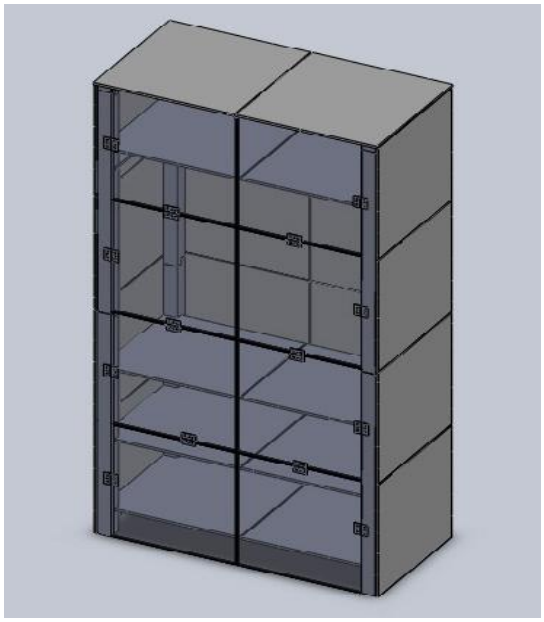

Figure 3.10: SolidWorks drawing

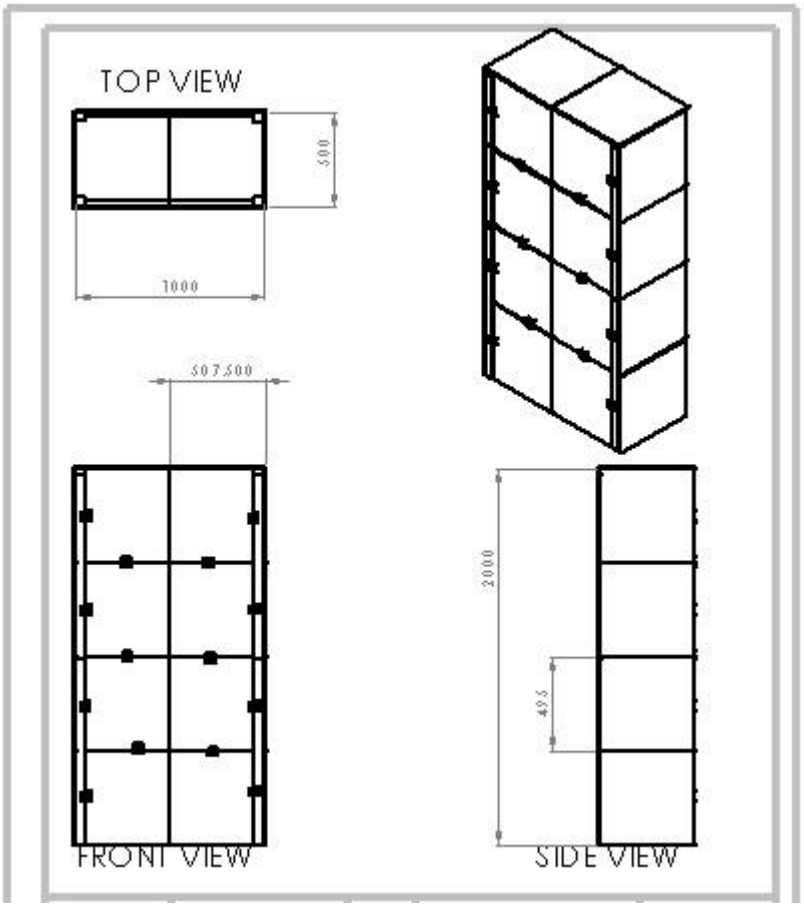

Figure 3.11: Dimension

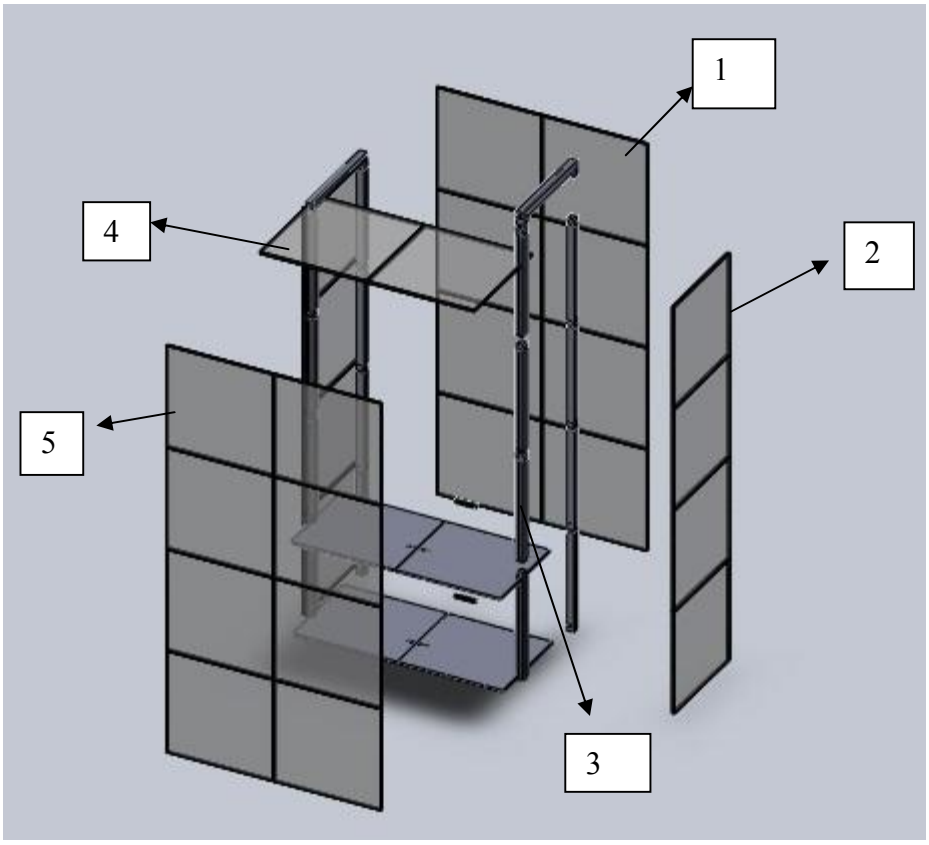

Figure 3.12: Exploded view and part number

3.5.1 Folding step of each part

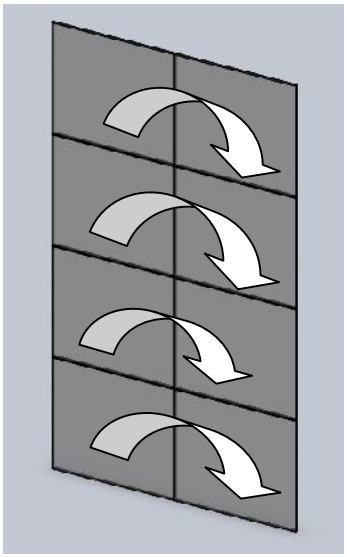

Figure 3.13: Fold part 1

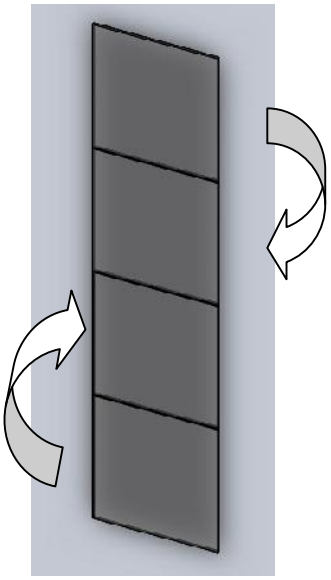

Figure 3.14: Fold part 2

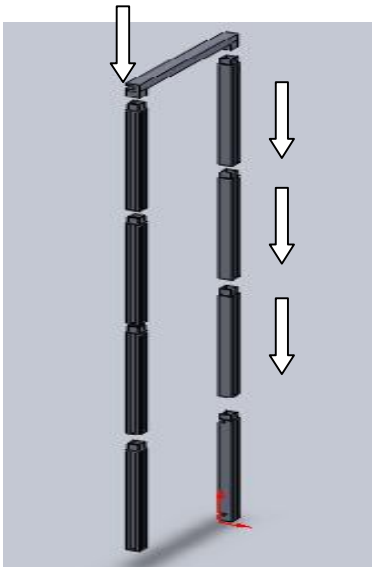

Figure 3.15: Join part 3

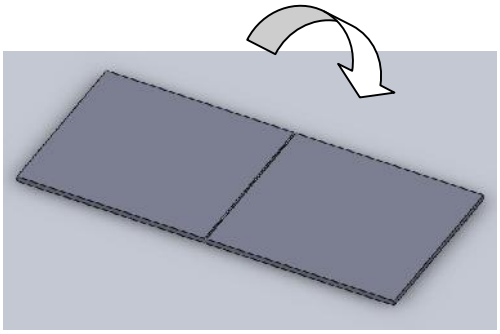

Figure 3.16: Fold part 4

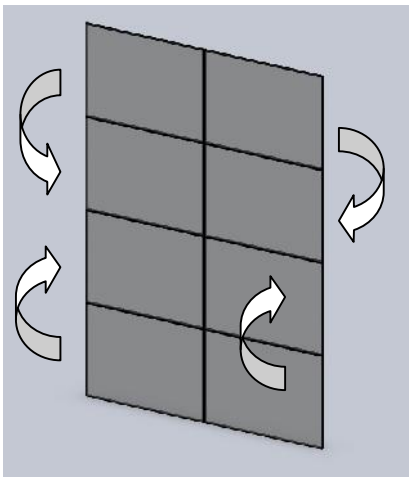

Figure 3.17: Fold part 5

3.6 FABRICATION PROCESS OF PRODUCT

After all selecting material done, there are few processes that must be completed in order to fabricate the cupboard design.

3.6.1 Measure the selected material (Measuring Tape)

All selected material must be measured precisely according to the drawing before continuing the cutting process. Measurement must based on the drawing.